

# Investigative Research, FMECA and PHM Modeling of Hybrid-Electric Distributed Propulsion System Architectures, Phase I

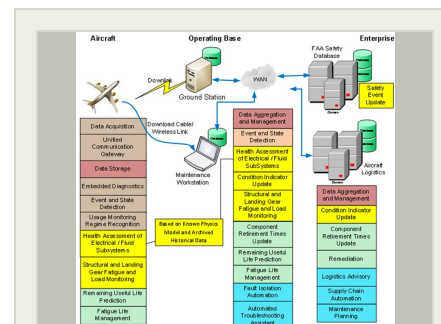
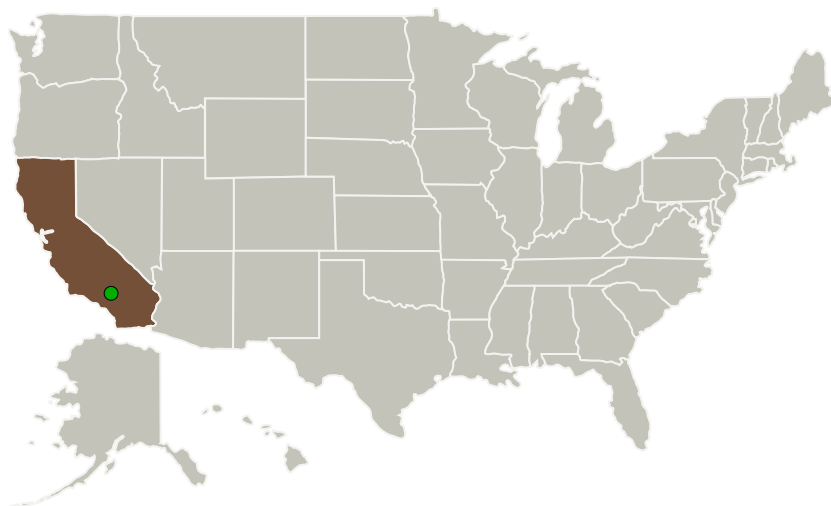
Completed Technology Project (2013 - 2013)



## Project Introduction

Hybrid-Electric distributed propulsion (HEDP) is becoming widely accepted and new tools will be required for future development with validation and demonstrations during ground and eventually flight testing. To monitor the overall HEDP system health in real time, a virtual requirement to flight qualify any architecture hardware components, reliability centered maintenance (RCM) applied to prognostics and health management (PHM) will yield significant improvement in HEDP system reliability, availability, safety and cost. This work will identify the tools and create a generic methodology for the PHM of a HEDP system based on RCM and failure mode data of likely HEDP architecture components. The proposed work will notionally design a PHM system into a HEDP system architecture, with feedback systems from each component within the stated architecture, as well as potential mitigation strategies for component failure modes. Specific attention will be applied to understanding of the reliability, availability, and safety for the HEDP components. Heating, arching, unexpected voltage drop, and other potential electronic pitfalls will be identified and mitigated. ESAero will leverage their component databases, experience with HEDP component architectures, aircraft design, and vendor relationships while General Atomics (GA) will provide expertise in PHM with their HealthMap software.

## Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Empirical Systems Aerospace, Inc.(ESAero)	Lead Organization	Industry	Pismo Beach, California
● Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California

## Primary U.S. Work Locations

California

## Project Transitions

**May 2013:** Project Start**November 2013:** Closed out

## Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140696>)

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Empirical Systems Aerospace, Inc. (ESAero)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

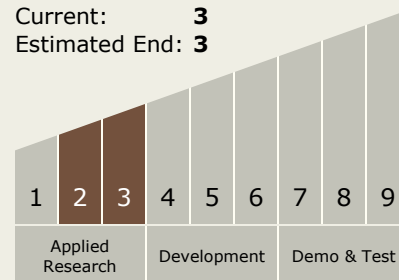
Benjamin T Schiltgen

## Technology Maturity (TRL)

Start: 2

Current: 3

Estimated End: 3

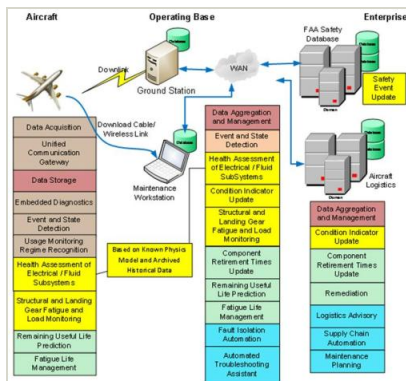


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## Images



## Project Image

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(<https://techport.nasa.gov/image/135956>)

## Technology Areas

### Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - └ TX12.3 Mechanical Systems
    - └ TX12.3.4 Reliability, Life Assessment, and Health Monitoring

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System